

SYSTEMATICS AND DISTRIBUTION OF SHREWS OF  
THE GENUS *CROCIDURA* (MAMMALIA:  
INSECTIVORA) IN VIETNAM

Lawrence R. Heaney and Robert M. Timm

*Abstract.*—Three noncommensal species of white-tooth shrews (*Crocidura*) are found in Vietnam; from smallest to largest, they are *C. horsfieldi indochinensis*, *C. attenuata*, and *C. fuliginosa dracula*. All are probably widespread, although their distributions remain incompletely known in Vietnam.

---

Shrews of the genus *Crocidura* are the most widespread and diverse insectivores in the Oriental faunal region (Chasen 1940; Ellerman and Morrison-Scott 1951). However, there are few specimens from most areas, and this is especially true of the continental portions of southeast Asia. We recently surveyed the holdings of the American Museum of Natural History (AMNH), Field Museum of Natural History (FMNH), and U.S. National Museum of Natural History (USNM), and have encountered a number of misidentified specimens and important unpublished records of three species of *Crocidura* from Vietnam. Because past investigators have been hampered by a lack of adequate descriptions and illustrations, we provide these here, along with reidentifications of previously published, misidentified specimens. Localities are mapped or listed in gazetteers by Moore and Tate (1965), Osgood (1932), and Van Peenen *et al.* (1969). We do not treat the common commensal species of the subgenus *Suncus*, *C. murina*, in this paper; see Van Peenen *et al.* (1969) for a list of localities for this species in southern Vietnam.

All cranial measurements were taken by Heaney with dial calipers graduated to 0.05 mm. External measurements were taken from the collectors labels. The following cranial measurements were taken: condyloincisive length, condyles to anterior tip of incisors; braincase breadth, greatest breadth, roughly mastoidal; interorbital breadth, taken at anterior end of orbit; rostral length, anterior tip of incisor to anteriormost portion of orbit, in the infraorbital foramen; postpalatal depth, measured from just posterior to posterior lip of palate to closest point on cranial surface; rostral breadth, calipers held dorsally to rostrum, measurement taken at margin of P<sup>2</sup> and P<sup>3</sup>, in "notch"; postpalatal length, taken from posterior edge of postpalatal lip to anteriormost point on foramen magnum; condyle to glenoid, calipers placed in glenoid fossa, drawn up against posteriormost point on occipital condyles; I<sup>1</sup> to M<sup>3</sup>, greatest length of toothrow, at alveolus of M<sup>3</sup> to anteriormost point on I<sup>1</sup>; P<sup>4</sup> to M<sup>3</sup>, taken labially at alveolus; M<sup>2</sup> to M<sup>2</sup>, greatest width taken at anterior labial margins of second upper molars; palatal width at M<sup>3</sup>, alveolar distance between lingual margins of third upper molars.

*Crocidura attenuata* Milne-Edwards

*Crocidura attenuata* Milne-Edwards, 1872:263.

These shrews are virtually identical to the species that follow in pelage characteristics; thus, the following description of the pelage applies equally well to

Table 1.—External and cranial measurements of white-toothed shrews from Vietnam. Values are means  $\pm$  standard deviation (and range).

Measurements	<i>Crocidura attenuata</i> (n = 9)	<i>Crocidura fuliginosa</i> (n = 17)	<i>Crocidura horsfieldi</i> (n = 4)
Length of head and body	83.9 $\pm$ 3.6 (79–88)	92.5 $\pm$ 5.9 (83–101)	66.0 (65–67)
Length of tail	50.0 $\pm$ 6.5 (45–61)	71.2 $\pm$ 4.3 (62–80)	48.5 (47–50)
Length of hind foot	14.3 $\pm$ 0.71 (13–15)	16.2 $\pm$ 1.2 (15–18)	13.0 (13)
Condylolncisive length	20.88 $\pm$ 0.95 (19.6–22.4)	23.63 $\pm$ 0.43 (22.9–24.2)	17.77 (17.7–17.9)
Braincase breadth	9.51 $\pm$ 0.27 (9.1–9.9)	10.23 $\pm$ 0.18 (9.9–10.5)	8.13 (8.0–8.2)
Interorbital breadth	4.58 $\pm$ 0.22 (4.2–4.9)	4.93 $\pm$ 0.12 (4.7–5.1)	3.95 (3.8–4.1)
Rostral length	8.18 $\pm$ 0.25 (7.9–8.6)	9.52 $\pm$ 0.28 (8.8–9.8)	6.6 (6.4–6.7)
Postpalatal depth	3.77 $\pm$ 0.14 (3.5–3.9)	4.18 $\pm$ 0.13 (3.9–4.4)	3.48 (3.4–3.6)
Rostral breadth	2.67 $\pm$ 0.19 (2.3–3.0)	2.71 $\pm$ 0.11 (2.6–2.9)	2.28 (2.0–2.6)
Postpalatal length	9.25 $\pm$ 0.47 (8.6–9.9)	10.41 $\pm$ 0.29 (10.0–11.0)	8.27 (7.9–8.5)
Condyle to glenoid	8.20 $\pm$ 0.39 (7.7–8.7)	8.97 $\pm$ 0.15 (8.8–9.2)	7.20 (7.2)
I <sup>1</sup> to M <sup>3</sup>	9.08 $\pm$ 0.36 (8.6–9.7)	10.65 $\pm$ 0.21 (10.3–11.0)	7.48 (7.3–7.6)
P <sup>4</sup> to M <sup>4</sup>	5.09 $\pm$ 0.21 (4.9–5.5)	5.99 $\pm$ 0.15 (5.7–6.2)	4.20 (4.1–4.4)
M <sup>2</sup> to M <sup>2</sup> (labial)	6.39 $\pm$ 0.38 (5.7–6.8)	6.95 $\pm$ 0.21 (6.5–7.4)	5.35 (4.9–5.7)
Palatal width at M <sup>3</sup>	2.84 $\pm$ 0.17 (2.6–3.1)	2.99 $\pm$ 0.08 (2.8–3.1)	2.20 (2.0–2.3)

all three species. Dorsal pelage soft, dense; color grayish brown, hairs often tipped with silver, slate gray at base. Ventral pelage shorter, slightly more grayish. Ear covered inside and out with fine, scattered brown hairs; these hairs are densest along edge, giving ear a brownish fringe. Distal septum of ear with stiff brown hairs protruding beyond margin. Fore-feet and hind-feet with sparse covering of brown hairs on dorsum; ventral surface naked of hairs. Tail thinly covered with brown hairs. Long hairs sparse but present on proximal two-thirds of tail, absent from distal third. Ventral surface of tail paler, grading into darker dorsum.

*Crocidura attenuata* differs from *C. fuliginosa* externally in its generally smaller size (Table 1), and especially in its proportionately and absolutely shorter tail; the average tail to head and body ratio is 0.50. *Crocidura attenuata* differs externally from *C. horsfieldi* in being considerably larger (head and body more than 79 mm as opposed to less than 67 mm), and in having a proportionately shorter tail.

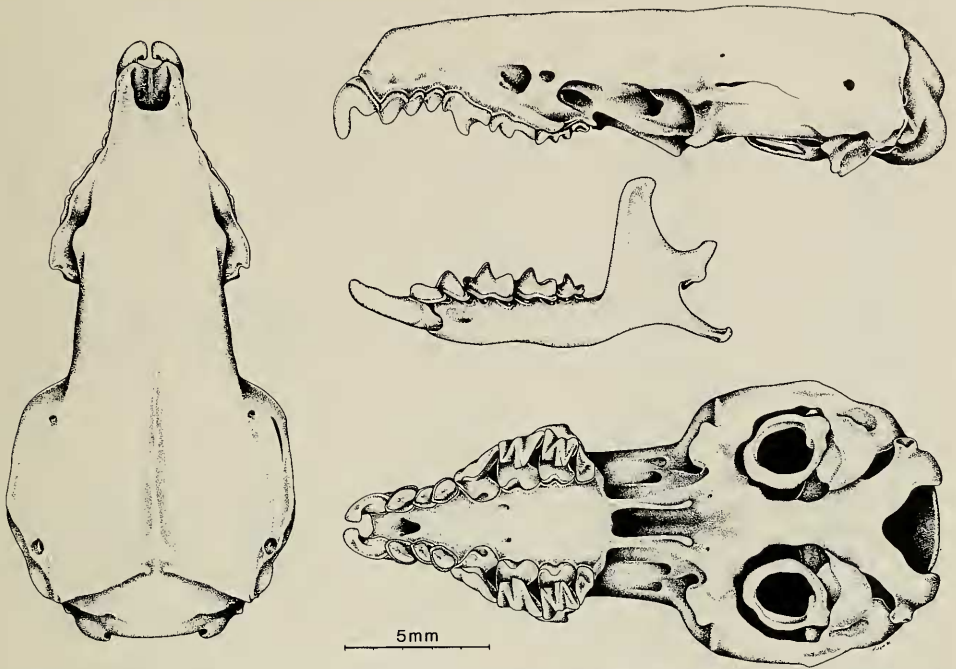


Fig. 1. Dorsal, lateral, and ventral views of the cranium and lateral view of the mandible of *Crocidura attenuata* from Mt. Langbian, Tuyen Duc Province, Vietnam (FMNH 46640). Approximately  $\times 4$ .

The skull of *C. attenuata* (Figs. 1, 2) is similar to those of *C. fuliginosa* and *C. horsfieldi* in most respects. It differs from *C. fuliginosa* in being generally smaller; having a shorter and less massive tooththrow, especially in having narrower molars (Fig. 2); having the second upper unicuspid conspicuously smaller than first or third; more rounded (U-shaped) base to the basisphenoid between the pterygoid processes; and a narrower strut of the maxillary over the infraorbital canal (Fig. 2). *Crocidura attenuata* differs from *C. horsfieldi* in having a larger skull (Table 1); a proportionately broader anterior tip to the rostrum; more procumbent incisors; and in having the third unicuspid about three-fourths the size of the first, rather than about half (Fig. 2).

These are the first specimens reported from Vietnam. As noted by Jenkins (1976), *C. attenuata* often has been confused with *C. fuliginosa*, and most of the specimens we examined have been reported previously in the literature as *C. fuliginosa*. Our identifications are based on measurements provided by Jenkins (1976), on comparisons with specimens (FMNH) from near the type locality of *C. attenuata* (see Allen 1938), and the illustrations and description published by Milne-Edwards (1872). Only one of the specimens from the USNM reported by Van Peenen *et al.* (1969) as *C. fuliginosa* is actually that species; the others are *C. attenuata*. The specimens cited here indicate that *C. attenuata* is widespread in southern Vietnam at elevations from near sea level to 1700 m. We note that the cranium of a *Crocidura* from Thailand figured by Lekagul and McNeely (1977: 31) and identified as *C. fuliginosa* is actually *C. attenuata*, whereas the skull and

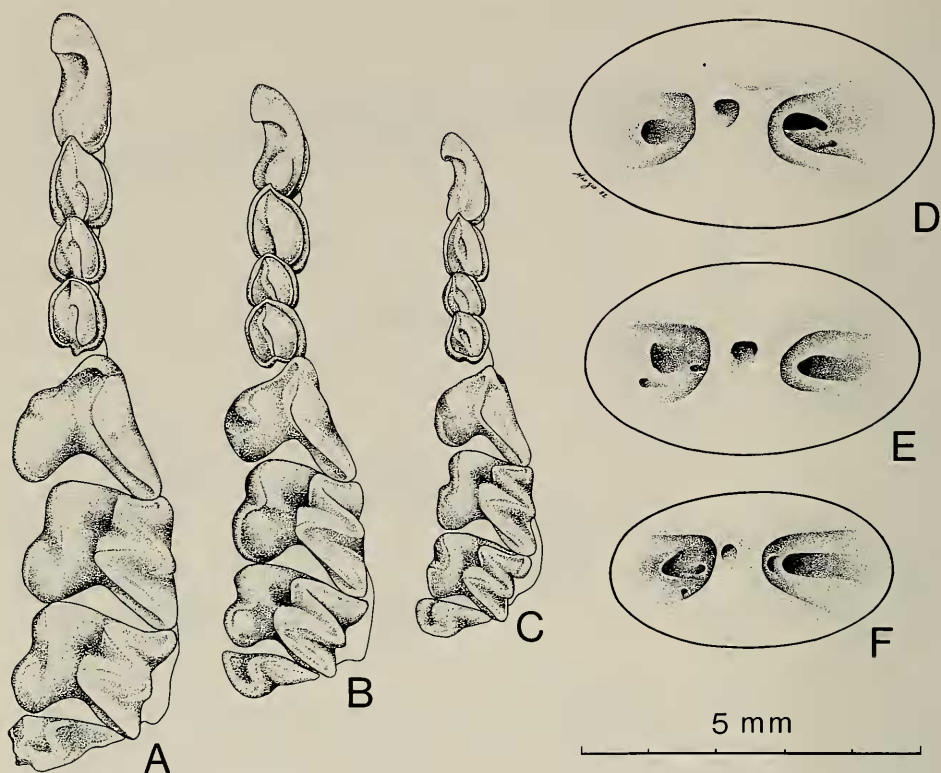


Fig. 2. Maxillary tooththrows of *Crocidura fuliginosa* (A; FMNH 32422 from Chapa, Tonkin), *C. attenuata* (B; FMNH 46640 from Langbian Peak, Tuyen Duc Prov.), and *C. horsfieldi* (C; FMNH 39029 from Chapa, Mt. Fan Si Pan, Tonkin); and infraorbital regions of *C. fuliginosa* (D; USNM 357438 from Con Son Island), *C. attenuata* (E; FMNH 46641 from Langbian Peak, Tuyen Duc Prov.), and *C. horsfieldi* (F; USNM 357862 from An Khe Military Base, Binh Dinh Prov.). All drawings to same scale, approximately  $\times 9$ .

measurements Lekagul and McNeely (1977:34) attribute to *C. attenuata* are those of *C. fuliginosa*.

As noted by Jenkins (1976), the subspecific status of Indochinese specimens is uncertain, although Lekagul and McNeely (1977) thought Thai specimens probably represented *C. a. attenuata*.

*Specimens examined*.—VIETNAM: *Quan Tri Prov.*: 2.3 km E, 8 km S Thon Ke Tri Peak, elev. 70 m (1 USNM); *Thua Thien Prov.*: 8 km W, 3.7 km N Nui Ke, elev. 30 m (1 USNM); 9.1 km W, 3.6 km N Nui Ke, elev. 30 m (1 USNM); *Tuyen Duc Prov.*: Fyan, elev. 1200 m (1 USNM); Mt. Langbian (no elevation given; 3 FMNH); Mt. Langbian, elev. 1700 m (2 USNM).

*Crocidura fuliginosa dracula* Thomas

*Crocidura fuliginosa dracula* Thomas, 1912:686.

As noted above, these shrews have pelage virtually identical to that of the other species, although we note that the skin on the hind feet of this species



appears to be paler dorsally than that of *C. attenuata* or *C. horsfieldi*. *Crocidura fuliginosa* differs cranially from *C. attenuata* as noted above; it differs from *C. horsfieldi* most conspicuously in its vastly larger size (Table 1, Fig. 2), and also in its proportionately larger  $P^4$ .

*Crocidura fuliginosa* is widespread in southeast Asia (Jenkins 1976; Medway 1977), and has been reported previously from Vietnam (Osgood 1932); most of the specimens we examined were reported by Osgood. As noted above, Van Peenen *et al.* (1969) reported this species from Con Son Island; their other records are here referred to *C. attenuata*. We have records of *C. fuliginosa* only from Con Son Island and from northern Vietnam, from elevations from 40 m to ca. 1600 m, although the species is known to occur in southern Thailand and Malaysia (Lekagul and McNeely 1977; Medway 1977). This species apparently occurs sympatrically with *C. horsfieldi* near Chapa in northwestern Tonkin. Van Peenen *et al.* (1969) cited Thomas (1927) as reporting a specimen of *C. fuliginosa* from Dakto, but Thomas actually referred to it as "*Crocidura* sp.," and we consider its identity to be uncertain. Our identifications are based on the discussion of the status of *C. fuliginosa* by Medway (1977), on comparison with specimens (FMNH) from China (see Allen 1938), and on data provided by Jenkins (1976). The recognition of *dracula* as a valid species by Lekagul and McNeely (1977) is based on their confusion regarding *C. fuliginosa* and *C. attenuata* (see above); our examination of specimens supports the recognition by Jenkins (1976) of *dracula* as a subspecies of *fuliginosa*.

*Specimens examined*.—VIETNAM: *Con Son Prov.*: Con Son Island, 1 km S, 0.3 km W Airfield Bldg., elev. 40 m (1 USNM); *Annam*: Hoi-Xuan (1 FMNH); *Tonkin*: Ba Nam Nhung (1 FMNH); Chapa, elev. 5000 ft (10 FMNH); Lai Chau, elev. 500 ft (1 AMNH, 2 FMNH); Muong Mo (1 FMNH).

#### *Crocidura horsfieldi indochinensis* Robinson and Kloss

*Crocidura horsfieldi indochinensis* Robinson and Kloss, 1922:88.

This species is similar in appearance to *C. attenuata*, but differs in its smaller size, proportionately longer tail (tail to head and body ratio averages 0.74), and several cranial features noted above (Fig. 2). It is conspicuously different from *C. fuliginosa* in its much smaller size.

Robinson and Kloss (1922) described *indochinensis* on the basis of a single specimen from Dalat (5000 ft elev.), Langbian Plateau (=Mt. Langbian), Tuyen Duc Prov., southern Annam (Vietnam); they provided (among others) the following measurements: tail, 50; hind foot, 12.2; greatest length of skull, 17.2; maxillary toothrow to tip of incisors, 7.4; mastoid breadth, 8.1. These measurements fit well within the range of those presented here, and it is on this basis that we refer our specimens to this taxon. Osgood (1932) reported two specimens from Chapa, in extreme northwestern Vietnam, and Anthony (1941) extended the known distribution to northeastern Burma. Ellerman and Morrison-Scott (1951) were the first to list *indochinensis* as a subspecies of *C. horsfieldi*, but offered no explanation for doing so. This treatment was followed by Jenkins, who stated that the holotype of *indochinensis* was similar to topotypes of *C. horsfieldi*. We list *indochinensis* as a subspecies of *C. horsfieldi* strictly on that basis. Lekagul and McNeely (1977) also followed this treatment, listing specimens from Chengmai

and Kao Yai Park in Thailand. Specimens we examined all were taken at or above 600 m elevation. We note that *C. attenuata* and *C. h. indochinensis* have both been taken on Mt. Langbian.

*Specimens examined*.—VIETNAM: *Tonkin*: Chapa, Mt. Fan Si Pan (1 FMNH); *Binh Dinh Prov.*: An Khe Military Base, elev. approx. 600 m (2 USNM); *Tuyen Duc Prov.*: Mt. Langbian, elev. 1700 m (1 USNM).

### Acknowledgments

We thank G. G. Musser and R. W. Thorington for permission to examine specimens under their care, K. F. Koopman and R. S. Voss for their comments on the manuscript, Rosanne Miezio for her fine illustrations, and G. Lake for assistance with preparing the manuscript.

### Literature Cited

- Allen, G. M. 1938. The mammals of China and Mongolia. *Natural History of Central Asia*, 11: xxv+620 pp.—American Museum of Natural History, New York.
- Anthony, H. E. 1941. Mammals collected by the Vernay-Cutting Burma Expedition.—*Field Museum of Natural History, Zoological Series* 27:37–123.
- Chasen, F. N. 1940. A handlist of Malaysian mammals.—*Bulletin of the Raffles Museum, Singapore* 15:xx+1–209.
- Ellerman, J. R., and T. C. S. Morrison-Scott. 1951. Checklist of Palearctic and Indian mammals 1758–1946.—*British Museum (Natural History), London*, 810 pp.
- Jenkins, P. D. 1976. Variation in Eurasian shrews of the genus *Crocidura* (Insectivora: Soricidae).—*Bulletin of the British Museum (Natural History), Zoology* 30(7):269–309.
- Lekagul, B., and J. A. McNeely. 1977. *Mammals of Thailand*.—Kurusapha Ladprao Press, Bangkok. li+758 pp.
- Medway, L. 1977. Mammals of Borneo: field keys and an annotated checklist.—*Monographs of the Malaysian Branch of the Royal Asiatic Society* 7:xii+1–172.
- Milne-Edwards, A. 1872. *Recherches pour servir a l'histoire naturelle des mammifères*.—G. Masson, Paris.
- Moore, J. C., and G. H. H. Tate. 1965. A study of the diurnal squirrels, Sciurinae, of the Indian and Indochinese subregions.—*Fieldiana: Zoology* 48:1–351.
- Osgood, W. H. 1932. Mammals of the Kelley-Roosevelts and Delacour Asiatic Expeditions.—*Field Museum of Natural History, Zoological Series* 18(10):193–339.
- Robinson, H. C., and C. B. Kloss. 1922. New Mammals from French Indo-China and Siam.—*Annals and Magazine of Natural History* (9) 9:87–99.
- Thomas, O. 1912. New species of *Crocidura* and *Petaurista* from Yunnan.—*Annals and Magazine of Natural History* (8)9:686–688.
- . 1927. The Delacour exploration of French Indo-China. Mammals.—*Proceedings of the Zoological Society of London* 1927:41–58.
- Van Peenen, P. F. D., P. F. Ryan, and R. H. Light. 1969. Preliminary identification manual for mammals of South Vietnam.—*United States National Museum, Washington*. vi+310 pp.

(LRH) Museum of Zoology and Division of Biological Sciences, University of Michigan, Ann Arbor, Michigan 48109; (RMT) Division of Mammals, Field Museum of Natural History, Chicago, Illinois 60605-2496.